

CLAIMS

1 A method for determining latency of a selected path in a computer network hav-
2 ing a plurality of network nodes, the computer network further including a first entity
3 disposed at one end of the selected path and a second entity disposed at a second end of
4 the selected path, the method comprising the steps of:
5 establishing a path state at each network node along the selected path for identi-
6 fying a traffic flow having predefined parameters, and for forwarding messages matching
7 the predefined parameters of the traffic flow to a next downstream network node along
8 the selected path;
9 generating a test message at the first entity, the test message addressed to the sec-
10 ond entity and configured in accordance with the predefined parameters of the traffic
11 flow;
12 placing a time record in the test message;
13 transmitting the test message from the first entity;
14 in response to receiving the test message at each network node, forwarding the
15 test message from the receiving network node to the next downstream network node
16 along the selected path by virtue of the previously established path states;
17 in response to receiving the test message at a last downstream network node along
18 the selected path, forwarding the test message to the second entity by virtue of the previ-
19 ously established path states;
20 using the time record placed in the test message to determine the latency of the
21 selected path.

1 2. The method of claim 1 wherein the predefined parameters of the traffic flow in-
2 clude at least a network layer address associated with the first entity and a network layer
3 address associated with the second entity.

1 3. The method of claim 2 wherein the step of establishing comprises the steps of:
2 formulating at least one path state setup message at the first entity, the at least one
3 path state setup message addressed to the second entity and including:

4 the predefined parameters of the traffic flow; and
5 a source routing option that lists, in sequential order, each network node
6 along the selected path;
7 transmitting the at least one path state setup message from the first entity into the
8 computer network;
9 in response to receiving the at least one path state setup message at each network
10 node, forwarding the at least one path state setup message from the receiving network
11 node to the next downstream network node along the selected path by virtue of the source
12 routing option;
13 in response to receiving the at least one path state setup message at the last down-
14 stream network node along the selected path, forwarding the at least one path state setup
15 message to the second entity.

1 4. The method of claim 3 wherein the step of establishing further comprises the
2 steps of:
3 formulating at least one path state reservation message at the second entity, the at
4 least one path state reservation message addressed to the last downstream network node
5 along the selected path and including the predefined parameters of the traffic flow;
6 transmitting the at least one path state reservation message from the second entity
7 into the computer network;
8 in response to receiving the at least one path state reservation message at each
9 network node, including the last downstream network node, (1) establishing a path state
10 corresponding to the predefined parameters of the traffic flow, and (2) sending at least
11 one corresponding path state reservation message from the receiving network node to a
12 next upstream network node;
13 in response to receiving the at least one path state reservation message at a last
14 upstream network node along the selected path, forwarding the path state setup message
15 to the first entity.

1 5. The method of claim 4 wherein the step of using comprises the steps of:

2 generating a second test message at the second entity, the second test message ad-
3 dressed to the first entity and containing the time record from the received test message;
4 transmitting the second test message from the second entity to the first entity;
5 constraining the second test message to follow the selected path in the computer
6 network;
7 upon receiving the second test message at the first entity, comparing the time rec-
8 ord with a current time to determine the latency of the selected path.

1 6. The method of claim 5 wherein the step of constraining comprises the steps of
2 establishing a second path state at each network node along the selected path for identi-
3 fying a second traffic flow having predefined parameters, and for forwarding messages
4 matching the predefined parameters of the traffic flow to the next upstream network node
5 along the selected path, wherein
6 the second test message generated by the second entity is configured in accordance with
7 the predefined parameters of the second traffic flow.

1 7. The method of claim 4 wherein the step of using comprises the steps of:
2 providing a clock management facility at each of the first and second entities;
3 synchronizing the clock management facilities at the first and second entities;
4 upon receiving the test message at the second entity, comparing the time record
5 with a current time to determine the latency of the selected path.

1 8. A computer readable medium containing executable program instructions for
2 generating a path state setup message, the path state setup message for establishing a path
3 state at one or more network nodes along a selected path of a computer network, the ex-
4 ecutable program instructions comprising steps for:
5 inserting into the path state setup message a source routing option that lists one or
6 more network nodes along the selected path; and
7 inserting into the path state setup message one or more parameters that define a
8 selected traffic flow that is to be associated with a test message for determining a latency
9 of the selected path.

1 9. The computer readable medium of claim 8 comprising further program instruc-
2 tions for listing each of the network nodes along the selected path in the source routing
3 option.

1 10. The computer readable medium of claim 9 comprising further program instruc-
2 tions for rendering the path state setup message free from having a sender traffic speci-
3 fier.

1 11. The computer readable medium of claim 10 comprising further program instruc-
2 tions for inserting into the path state setup message a router alert option.

1 12. The computer readable medium of claim 8 comprising further program instruc-
2 tions for rendering the path state setup message free from having a sender traffic speci-
3 fier.

1 ~~13.~~ A network node for use in a computer network, the network node comprising:
2 a plurality of interfaces configured to receive and forward messages;
3 an options processor in communicating relationship with the plurality of inter-
4 faces, the options processor configured to implement one or more options included in a
5 received path state setup message identifying a traffic flow; and
6 a signaling protocol processor in communicating relationship with the options
7 processor,
8 wherein the options processor and signaling protocol processor cooperate to implement a
9 source routing option included in the path state setup message by initializing a path state
10 associated with the traffic flow and forwarding the path state setup message to a next
11 network node as identified in the source routing option.

1 14. The network node of claim 13 further wherein the signaling protocol processor, in
2 response to receiving a path state reservation message at the network node, establishes
3 the previously initialized path state.

1 15. The network node of claim 14 wherein the path state reservation message includes
2 one or more parameters that define a selected traffic flow, the network node further com-
3 prising a packet classifier operatively coupled to the signaling protocol processor,
4 whereby the signaling protocol processor configures the packet classifier to identify for
5 messages matching the one or more parameters of the selected traffic flow.

1 16. The network node of claim 15 further comprising a packet scheduler operatively
2 coupled to the signaling protocol processor, whereby the signaling protocol processor
3 establishes a short-cut at the packet scheduler for application to messages identified by
4 packet classifier as matching the one or more parameters of the selected traffic flow.

1 17. The network node of claim 16 wherein the signaling protocol processor is a re-
2 source reservation protocol processor.